FW: NRT Chairman from LAEO--Copy of Letter Sent Certified Mail
Vivian Warden
to:
FOIA HQ
10/24/2013 01:20 PM
Cc:
James Bove, Patrick Easter, Lynn Beasley
Hide Details
From: Vivian Warden/DC/USEPA/US

To: FOIA HQ

Cc: James Bove/DC/USEPA/US, Patrick Easter/DC/USEPA/US, Lynn Beasley/DC/USEPA/US

4 Attachments


image002.jpg LETTER TO CRAIG MATTHIESSEN4.25.doc


Bioremediationtechniques_Corrected_ScienceLAEO_FF.pdf LAEO to NRT10.23.2013.docx

Sorry, Linda, here are the attachments needed for created this new FOIA request in FOIAonline. Thank you.

From: Bove, James
Sent: Thursday, October 24, 2013 12:25 PM
To: Warden, Vivian
Cc: Lynch, Mary-Kay; Easter, Patrick; Salo, Earl; Matthiessen, Craig
Subject: FW: NRT Chairman from LAEO--Copy of Letter Sent Certified Mail

Hi Vivian,

I spoke with Alan Margolis today about the letter from LAEO, attached below. He asked that I forward it to you to be entered as a FOIA that should be assigned to OEM.

I've highlighted the section regarding the FOIA- Alan thought it may be a close call as to being overbroad/not a reasonable description, but thought it best to log this as a FOIA. OEM will need to follow up with the requestor

to determine the scope and address the cost issue. OGC can help with that effort.

Thanks, and please let me know if you have any questions/concerns.

Jim

From: Lynch, Mary-Kay
Sent: Wednesday, October 23, 2013 5:15 PM
To: Salo, Earl; Bove, James
Cc: Michaud, John; Lynch, Mary-Kay
Subject: FW: NRT Chairman from LAEO--Copy of Letter Sent Certified Mail

Attorney client privilege

Earl and Jim,

We will need to discuss this at our reg review at 11 Thursday. Let's meet at 10:30 to discuss. Prior to this please talk with Craig or Dana to get more information.

I would like to better understand exactly what is being requested. A few specific questions:

1. the letter references FOIA. Is this the FOIA request or is there a separate one?
2. Are they asking for the oil spill eater (?) to be added to Subpart J as a authorized device?
3. 3. Have they sent a letter to the CG and what is the CG response?
4. Has EPA responded to them by letter or email? Region 10?
5. Why isn't CG the lead or is this focused on our role under subpart J? Regional Plans? Trying to figure out the focus and action here.
6. Related litigation?

Thanks. mk

From: Garbow, Avi
Sent: Wednesday, October 23, 2013 5:04 PM
To: Lynch, Mary-Kay
Subject: FW: NRT Chairman from LAEO--Copy of Letter Sent Certified Mail

fyi

Avi Garbow
General Counsel
U.S. Environmental Protection Agency
(202) 564-1917 Cell (202) 674-1804

From: Diane Wagenbrenner [mailto:dianeearthorg@att.net]
Sent: Wednesday, October 23, 2013 4:58 PM

To: Tulis, Dana
Cc: Perciasepe.bob@Epa.gov; Perciasepe.Bob@epamail.epa.gov; Mccarthy, Gina; Mccarthy, Gina; Tulis, Dana; Matthiessen, Craig; Matthiessen, Craig; McLerran, Dennis; McLerran, Dennis; Garbow, Avi; Garbow, Avi; Stern, Allyn; 'Barbara Wiseman'
Subject: To: NRT Chairman from LAEO--Copy of Letter Sent Certified Mail

Dear Ms. Tulis, I am sending this letter by email hoping to expedite delivery and response. I have also mailed this letter with attachments hard copy to yourself (Certified mail, with request for signed receipt of delivery) and Certified/Priority mail to the cc's.
Hoping to be able to move forward on our original request soonest. Respectfully Submitted, Diane

Lawrence Anthony
EARTH ORGANIZATION
Because None Survive Alone

October, 23, 2013
National Response Team Chairman
Ms. Dana Tulis
U.S. EPA Office of Emergency Management
Ariel Rios Building (5104A)
1200 Pennsylvania Avenue, NW
Washington, DC 20460
202-564-8600

Dear Ms. Tulis,

As you may or may not be aware, Steven Pedigo and the Lawrence Anthony Earth Organization (LAEO) have been requesting that Oil Spill Eater II (OSE II) be preapproved/preauthorized by EPA and the USCG for use in water for approximately 15 years. EPA has done everything it could to avoid explaining why it is continuing to sole source COREXIT—which is made by Nalco, a company owned by EXXON and other various oil and gas companies. Its use allows oil companies to break the law, spill, damage the environment and fisheries and then profit by cleaning up their own mess. The public would be outraged if they knew what was really going on.

I am not sure if you have been tracking the emails and my correspondence with the Alaska RRT Co Chairs, but they bring to the forefront the same issue that Mark Everett (ARRT Co Chair) told me you acted on. He indicated that you assumed control over our request at the national, NRT level, to handle our formal request for the use of a non-toxic proven alternative to chemical dispersants.

The matter is simple to resolve in our minds: first EPA and the USCG have engaged in illegal sole source procurement for decades. Your denial of the use of OSE II when requested by OSCs, and sole sourcing of COREXIT, is based on incorrect science that has been disseminated throughout the NRT system. Your unit needs to be opened up to free and open competition and the erroneous science being put out broadly by your staff and internal documents must be corrected. Take into consideration that many states and citizens OPPOSE the use of any dispersant, including COREXIT, based on not only accurate scientific data but also the horrific

effects they have personally seen on their constituents, family members, and/or friends.

LAEO and the issue we are focused upon need to be separated from the complex matter involving inclusion of Tribal Governments in Alaska in the clash over dispersant use in Alaskan waters and the Arctic. That is a separate subject; however, it is indicative of the opposition to what you are doing by the peoples living there, as well as the communications problems inherent within the RRT system. It also highlights the EPA's and the USCG's lack of response to repeated public inquiries on this issue.

LAEO is demanding under FOIA, 5 USC 552 that you provide comprehensive documentation of the scientific principles, laws and regulations, documents and decisions on which your continued use of COREXIT/dispersants and denial of our requested non-toxic alternative--OSE II is justified.

We further are requesting an actual response to LAEO's formal request to Craig Matthiessen and yourself that asks for a correction to be made in the NRT Bioremediation Fact Sheet which is out of date by 13 years. That inaccurate fact sheet has been used to deny every OSC and RP request to use OSE II on US waters repeatedly over many years despite ample contrary science provided. To reiterate that request; I have re-attached the Email file and its attachments. Additionally, I am including LAEO's formal request sent to the Alaska RRT in May of 2013 (with several hundred pages of documentation supporting the request which can be found at: http://protectmarinelifenow.org/alaska-alliance

In summary, what LAEO cares about is cleaning up the waters. We want a final decision that either:

a. Permits the use of OSE II to help clean up the Gulf of Mexico and countless other extant spills on U.S. navigable waters which still need to be cleaned up, or

b. If not approved to use OSE II as a First Response methodology for U.S. Navigable Waters (OSE II is already used throughout the US on land based/soil and other hydrocarbon based spills, used by the US Military for years to successfully and economically remove hydrocarbon based spills from the environment in accordance with the Clean Water Act, etc.) that you provide us with an EXACT listing of reasons detailing why you will not permit OSE II to be used on U.S. waters. Our review of the history of this NCP Listed product indicates years of thorough and successful removal of hydrocarbon based spills from the environment, including use on ocean spills in other countries with ample EPA testing and science that supports its use for cleaning up the mess left behind in the Gulf of Mexico, Alaska, Enbridge etc. We want all documentation, correspondence that relates to your decision not to permit its use on U.S. waters, why such a decision was made and who exactly made these decisions. Your response must also include what *science* a 'no' decision is based on and any other reasoning.

In other words, we want a final decision that is a "Yes" or "No" with exact reasons given.

As you know, the OSEI Corporation CEO has been requesting a decision on the use of OSE II in U.S. navigable waters for more than 15 years and he has sent recent requests to all the RRTs, which, I presume, prompted you to elevate the Change Oil Spill Response Global Alliance's request to the Alaskan RRT to your office for decision.

Please be very clear: LAEO just wants a spill response that works, removes oil from the

environment, does not harm people, fisheries, wildlife or compromise the chemical and biological integrity of U.S. waters — which is the standard mandated by the Clean Water Act, 33 USC 1251 et.seq. LAEO has researched and vetted all NCP listed products and found one that satisfies all our criteria.

There is strong evidence that certain EPA employees have been collaborating with BP, Exxon and other major oil companies to give preferential treatment to chemical dispersants, namely COREXIT products. We also know that there is a major push at the Federal Government level to gain preauthorization and/or pre approval for chemical dispersant use on all U.S. coastlines. We do not know why this is going on, nor do we care. What we do care about is CLEANING UP THE GULF OF MEXICO SPILL USING OSE II and are asking that NRT personnel order all RRTs to cease and desist the illegal sole source procurement practices they are engaged in, or, the many stakeholders in this are prepared go to federal district court, expose the collaboration with the oil companies to the media and public, and we will seek damages from EPA and the USCG as well as seek individual personal liability from all agency personnel involved in perpetuating the use of oil company collaborated false science blocking the use of OSE II and in favor of destructive chemicals.

We will await your response.
Sincerely Yours,

Diane

Diane Wagenbrenner
VP Operations & Public Information
Lawrence Anthony Earth Organization
email: dianeearthorg@att.net
Ph: 858-531-6200

&

Barbara Wiseman
Lawrence Anthony Earth Organization
International President

CC: Gina McCarthy, EPA Administrator
CC: Avi, Garbo, EPA General Counsel
CC: Dennis McLerran, EPA, Region 10 Regional Administrator
CC: Allyn Stern, EPA, Region 10, Regional Counsel

Lawrence Anthony
EARTH
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Because None Survive Alone

October, 23, 2013

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Sincerely Yours,

Diane

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CC: Allyn Stern, EPA, Region 10, Regional Counsel

Lawrence Anthony
EARTH
ORGANIZATION
Because None Survive Alone

April 25, 2013

To: Craig Matthiessen

Regulation and Policy Development Division

EPA

From: Barbara Wiseman

International President

Lawrence Anthony Earth Organization

Dear Mr. Matthiessen:

Please find enclosed the Lawrence Anthony Earth Organization (LAEO), Science and Technology Advisory Board Position Paper: *A Call for a Twenty-First-Century Solution in Oil Spill Response.* We are distributing this globally through international media outlets, including copies sent directly to NRT, RRT, and interagency oil spill response network professionals in the United States.

While the paper itself covers many details that I won't repeat in this letter, I would like to address a specific EPA policy issue with you directly. This is the FOSC Fact Sheet used to govern critical decision-making during a spill incident: http://www.nrt.org/production/NRT/NRTWeb.nsf/AllAttachmentsByTitle/A-78bioremedFS/$File/bioremed_FS.pdf?OpenElement. This particular document has omitted and incorrect information that requires urgent revision regarding the different types of bioremediation and their modes of action, the details of which are documented in our publication. In the body of our paper is our recommended revision of the NRT Bioremediation Fact Sheet and the NRT, RRT 6 and 4 guidance

documents. I have excerpted this specific part and have attached it for you here, as well.

The LAEO is greatly concerned over the *current* human health and ecosystem impacts associated with the BP oil spill stemming from this erroneous policy/science guidance authored and distributed by the NRT/EPA throughout the NCP network.

While many aspects of the spill have been addressed in lessons learned by interagency reviews and studies, and are now subject to further examination in the ongoing federal trial, our analysis of the interagency response to the BP and other spills points to a serious POLICY deficiency – something from your position you could easily address which would vastly improve spill response methodology on a global scale.

We ask that you please read the attached paper and, following that, we would like to schedule a conference to further discuss.

Sincerely,

Barbara Wiseman

(818) 769-3410

Barbara@TheEarthOrganization.org

www.TheEarthOrganization.org

cc: EPA Administrator
D/Administrator
President Obama
Chair White House CEQ
Senator A.G. Crowe
cleanspillresponse@att.net

Attachments: 1. Spill Guide Overview

2. Proposed Revised Fact Sheet

3. Appendix A

4. LAEO Position Paper

BIOREMEDIATION TECHNIQUES, CATEGORY DEFINITIONS, AND MODES OF ACTION IN MARINE AND FRESHWATER ENVIRONMENTS

(Originally compiled to update and revise RRT IV Spill Response Guidance, *Types of Bioremediation* section and *Bioremediation Response Plan Appendix D*, in coordination with RRT VI and their Science and Technology Committee, who called for revisions in this material.)[1]

Steven Pedigo, CEO, OSEI Corp;
Marynette Herndon, Environ Eng, REM, CHMM;
Paul W. Sammarco, PhD

The purpose of this article is to update and supplement the National Response Team (NRT) Science and Technology Committee's *Bioremediation in Oil Spill Response Fact Sheet* published in May 2000 and RRT Guidance documents issued for OSCs and response professionals. Although existing NRT and RRT guidance covers important facts about bioremediation, existing material does not adequately define and differentiate between the three primary types of bioremediation categories listed on the NCP Product Schedule and their associated modes of action. This is important because their respective efficacies require precise application parameters, which vary between target environments. While the limitations and decision points related to bioremediation usage have been covered extensively in previously issued materials, this information is provided to simplify the OSC decision-making process when presented with the three primary bioremediation categories as options.

Essential facts stated in the *May 2000 NRT SCIENCE AND TECHNOLOGY COMMITTEE Fact Sheet: Bioremediation in Oil Spill Response*

"Several factors influence the success of bioremediation, the most important being the type of bacteria present at the site, the physical and chemical characteristics of the oil, and the oil surface area....

"Effective bioremediation requires that

1) nutrients remain in contact with the oiled material, and

2) nutrient concentrations are sufficient to support the maximal growth rate of the oil-degrading bacteria throughout the cleanup operation."[2]

NCP PRODUCT TYPES LISTED

The Bioremediation Agent Types listed on the NCP Product Schedule are designated as follows:

Microbiological Cultures	(MC)
Nutrient Additives	(NA)
Enzyme Additives	(EA)

The first type (MC) constitutes a bioremediation process that utilizes nonindigenous (foreign) bacteria. While useful in controlled environments, a prevailing concern with these types of products has been that the introduction of foreign species might cause future problems that may not become apparent for some time. The second type (NA) comprises those agents that contain nutrients or

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1. Submitted to RRT VI Science and Technology Committee in August 2012. Although the chair of the committee stated that key portions of this paper would be integrated into the revised guidance, as of the date of this position paper, that has not yet taken place. While facts about MC and NA Bioremediation Types have been covered in these NRT and RRT Fact Sheets, these materials completely omit any information and important facts on the NCP-listed EA Bioremediation Category and its mode of action, which are critical to accurate decision making using science-based protocols.

2. Bioremediation (Types MC and NA) for open-water spills is not considered to be appropriate or achievable because of the above two requirements. When nutrients are added to a floating slick, they immediately disperse into the water column, being diluted to near-background levels (with the exception of NCP-listed Type EA, based on extensive field use and testing on fresh and weathered hydrocarbons/oil, which recently demonstrated an 80 percent rate of PAH degradation on Macondo Block, La., sweet crude containing Corexit, per BP Biochem Strike Team leader D. Tsao, LSU R. J. Portier, and L. M. Basirico, *Laboratory Screening of Commercial Bioremediation Agents for the Deepwater Horizon Spill Response*, March 3, 2011).

fertilizers to support the microorganisms present in the spill environment. Both have been designated as not applicable to open-water environments. See 2001 EPA Guidance *Guidelines for the Bioremediation of Marine Shorelines and Freshwater Wetlands*, which extensively covers the usage of these two product types, so need not be repeated here.

On the other hand, the third type (EA) is appropriate as a first-response tool in open-water environments. Bioremediation EA Type has evolved in recent years and has been the subject of considerable technological advances, with wide applicability for oil spill response in fresh, brackish, and marine environments, under temperature conditions as low as 28°F. The mode of action of this type will be reviewed in detail here.

CONTEXT

The primary reason for cleaning up oil spills is to reduce or eliminate the toxic components, thus enabling the survival of fauna and flora, including single-cell organisms, in each niche of the food chain. Although dispersants commonly used today eliminate the visual and other damaging aspects of the spill on the surface, the spill's toxicity problem remains in the environment and at times is worsened by the adding of hydrocarbons contained in dispersants. The goal of the bioremediation process is to convert oil/hydrocarbon-based material to CO_2 and water, thereby permanently removing oil/hydrocarbons from the environment and returning the affected spill area to pre-spill conditions.

Herewith, the three main types of bioremediation are further defined, along with their modes of action, to help federal On-Scene Coordinators (OSCs) and federal, state, and local officials, as well as responsible parties, to understand, and make more informed decisions about, bioremediation agents when selecting oil spill response tools.

CATEGORY TYPE ENZYME ADDITIVE (EA)

Although the NRT and RRT guidance documentation addresses the MC and NA bioremediation types in the 2001 *Guidelines for the Bioremediation of Marine Shorelines and Freshwater Wetlands,*[3] they do not sufficiently detail the mode of action of *Bioremediation Type EA.*[4] This may be described as follows.

ENZYMATIC AGENT (EA) DEFINITION

Enzymatic agents are biocatalysts that are designed to enhance the emulsification and/or solubilization of oil to make it more available to microorganisms as a source of food or energy. These agents are generally liquid concentrates, which may be mixed with surfactants and nutrients manufactured through fermentation. This type of agent is intended to enhance biodegradation by indigenous microorganisms.

EA TYPE MODE OF ACTION

Enzyme Additive mode of action is applicable to open/moving water (fresh, salt, and brackish), marsh/estuaries, shoreline, and soil environments. When applied, the nontoxic converters and biosurfactants in Bioremediation Agent EA Type eliminate the classic appearance of an oil spill by emulsifying and solubilizing the molecular hydrocarbon structure and eliminating the adhesion properties of crude oil. This usually takes place within the first 5 to 30 minutes (depending upon temperature). The emulsified oil continues to float near the surface, thereby eliminating a secondary impact to the water column and seabed.

With the toxicity and adhesion properties eliminated, wildlife that may come in contact with the broken-down hydrocarbons will not become coated in oil, and oil adherence to marsh, shorelines, sands, and man-made structures is greatly reduced. Flammability is eliminated

3. 2001 Guidelines for the Bioremediation of Marine Shorelines and Freshwater Wetlands, http://www.epa.gov/osweroe1/docs/oil/edu/bioremed.pdf.

4. As of this date, there is only one product on the NCP list that falls under this Bioremediation Agent Type EA classification: B-53—EA—OIL SPILL EATER II; thus, descriptions above regarding the mode of EA interaction at this time are related solely to this EA product. Any newly added EA Type listings would require review and validation for being categorized here.

rapidly (again, depending upon temperature), helping to protect ports, harbors, and oil/gas platforms from potential explosion hazards associated with fuel spills.

A further action of bioremediation category EA is that its numerous enzymes then attach themselves to hydrocarbons with the biosurfactants, developing protein-binding sites. These sites act as a catalyst to accelerate the bioremediation process by inducing enhanced indigenous bacteria to utilize the detoxified oil/hydrocarbons as a food source. The EA category also contains properties that cause all the constituents to remain in contact with the spilled oil/hydrocarbons in moving waters.

Over ensuing days or weeks (again, depending on temperature), nontoxic nutrients in the Enzyme Additive Type rapidly facilitate an increase in indigenous bacterial populations. The bacteria consume the detoxified hydrocarbon emulsion, digesting the oil and reducing it to CO_2 and water—permanently removing the oil/hydrocarbons from the environment—resulting in final water clarification. Without category EA assistance, this natural process may take up to 20 years, based on the Ixtoc and *Valdez* spill studies.

SHORELINES / MARSHES

When a spill makes landfall or contaminates a marsh, category EA can be safely applied to lift the spill off the marsh grass (or sandy beaches or shorelines), limiting the time required for the oil to adversely impact these areas. The use of category EA does not deplete O_2 from water, since the oil is buoyant and the enzymes use atmospheric O_2 for their biochemical interactions.

There are no known trade-offs, deleterious effects, or collateral damage associated with the EA method.

There is no limited window of opportunity for the application of category EA; it can be used in estuaries, open marine (salt) waters, moving freshwater bodies such as rivers, and in soil. It is effective as a first-response tool and/or when applied days or months after a spill. Category EA can also be applied to oil accumulated on the seafloor, eventually lifting it to the surface and returning the seabed to pre-spill conditions.

CATEGORY TYPE MICROBIOLOGICAL CULTURE ADDITIVE (MC)

As covered in NRT Science and Technology Guidance, "... *bioaugmentation*" is the process by which "oil-degrading bacteria are added to supplement the existing microbial population."

DEFINITION

Microbial agents are concentrated cultures of oil-degrading microorganisms grown on a hydrocarbon-containing medium, which have been air- or freeze-dried onto a carrier (e.g., bran, cornstarch, oatmeal). In some cases, the microorganisms may be colonized in bioreactors at the spill site. All commercially available agents use naturally occurring microorganisms. Some agents may also contain nutrients to assure the activity of their microbial cultures. This type of agent is intended to provide a massive inoculum of oil-degrading microbes to the affected area, thereby increasing the oil-degrading population to a level where the spilled oil will be used as a primary source of food for energy. Microbial agents are designed to enhance the biodegradation of oil at any location and would be most useful in areas where the population of indigenous oil degraders is small.

MC TYPE MODE OF ACTION

Bioremediation Agent Type MC mode of action utilizes nonindigenous bacteria with the objective of digesting oil/hydrocarbons to CO_2 and water.

Bioaugmentation is considered a "polishing-up" or "finishing" response product, in that it cannot be applied to fresh oil because the toxicity levels kill the added oil-degrading bacteria.

When nonindigenous bacteria are placed on or near weathered oil, they attempt to release enough quantities of biosurfactants to detoxify the spill so that the oil-degrading bacteria will not be adversely impacted by the spill's toxicity,

enabling them to use the hydrocarbons as a food source. The oil-degrading bacteria (both indigenous and nonindigenous) produce enzymes to develop protein-binding sites, which permits the bacteria to convert the molecular structure of the hydrocarbons for use as a food source. This process requires a protracted amount of time.

While bioaugmented bacteria acclimate to the newly available oil, temperature of the environment, pH, and available nutrients, other environmental factors may produce adverse conditions that can forestall the breakdown action. These factors, along with the unknown time frames associated with their acclimation process, are at least partially responsible for the past uncertainty associated with using Bioremediation MC Type as a cleanup methodology.

Nonindigenous bacteria should generally be used where there is very little water movement. Water movement causes the products to become diluted to ineffective levels incapable of staving off natural competition from indigenous bacteria, and thus also incapable of supplying sufficient population numbers to produce enough biosurfactants and enzymes to start the breakdown of the molecular structure of the hydrocarbons. (Laboratory environments do not satisfactorily duplicate this type of competitive environment; hence, particularly in moving waters, the final outcome of treatment is often uncertain.)

Next to the toxicity of the spill, the most difficult aspect of utilizing nonindigenous bacteria in a foreign environment is natural competition from indigenous bacteria already acclimated to the target area. Indigenous bacteria are often competitively superior.

Bioaugmented bacteria developed specifically for fresh water must be used in freshwater settings only. Products containing saltwater bacteria can only be utilized in saltwater. MC Type bioremediation is best used on closed and/or controlled environments and should not be considered effective in open-water environments.

The use of nonindigenous bacteria in most countries is not permitted due to the uncertain effects of introducing them into sensitive environments.

CATEGORY TYPE NUTRIENT ADDITIVE (NA)

As covered in NRT Science and Technology Guidance, this next category (NA)—"*biostimulation*"—is a process "*in which nutrients, or other growth limiting substances, are added to stimulate the growth of indigenous oil degraders.*"

DEFINITION

Nutrient Additives are bioremediation agents that contain nitrogen and/or phosphorous as the primary means to enhance the rate of growth of indigenous oil-degrading microorganisms. This type of agent is intended to increase the oil-degrading biomass already present in an affected area to a level where the oil will be used as a primary source of food or energy. Because the natural environment may not have sufficient nutrients to encourage bacterial metabolism and growth, extra nutrients may be required. The purpose of this type of agent, therefore, is to provide the nutrients necessary to maintain or increase microbial activity and the natural biodegradation rate of spilled oil.

NA TYPE MODE OF ACTION

The NA mode of action involves the general use of nutrients or fertilizers that contain various volumes of nitrogen (N) and phosphorus (P). The nutrients are distributed in association with a spill and are expected to enhance the population growth of indigenous bacteria.

These bacteria need time to secrete biosurfactants to attack the molecular structure of the spill by solubilizing the oil/hydrocarbons, emulsifying the spill, and increasing the oil-water interface. This helps to detoxify the hydrocarbons to a point where enriched indigenous bacteria can utilize the spill as a food source.

It can be difficult to apply nutrients or fertilizers to a spill area containing toxic oil and be able to enhance bacterial population growth. Many of the indigenous bacteria are destroyed initially by the toxicity of the oil; and because of the oil's toxicity, the nutrients or fertilizers are usually precluded from augmenting the remaining indigenous bacteria.

Supplying nutrients or fertilizers in concentrations necessary to enhance bacteria while not increasing the nitrogen levels to the point where they become toxic to aquatic life is another key problem. In addition, it is difficult to contain the nutrients or fertilizers in the target area with the oil, especially in moving waters.

The process of enhancing indigenous bacteria with nutrients or fertilizers and waiting for them to secrete biosurfactants and enzymes in order to start the bioremediation process takes a protracted period of time. Again, this makes NA Type inappropriate as a first-response agent.

Bioremediation category NA can be effectively used where there is little tidal flush, and where the oil has weathered so its toxicity is reduced to the point that indigenous bacteria can survive. This requires NA to be used only as a polishing-up agent, with limited scope.

A BRIEF NOTE ON PHYTOREMEDIATION

Phytoremediation is defined as the use of green plants and their associated microorganisms to degrade, contain, or render harmless environmental contaminants.

Phytoremediation of petroleum hydrocarbons generally involves three major mechanisms: (1) degradation, (2) containment, and (3) the transfer of contaminants from the soil to the atmosphere.

For further information on applicability, consult page 87 of http://www.epa.gov/osweroe1/docs/oil/edu/bioremed.pdf.

CLOSING COMMENT

The three types of bioremediation and their modes of action (described above) have been detailed here to help responders understand how these agents will interact with a spill. The diverse types and their modes of action are clearly independent of each other, even though their end point in principle is the same; the ability to reach that end point, and the amount of time it takes to do so, is obviously different.

REFERENCES

Alleman, B. C., and E. A. Foote. 1997. Evaluation of Amendments for Enhancing Microbial Activity in Soils from Site 18 at MCAGCC, Twentynine Palms, California. Battelle, Columbus, OH. Performing Organization Report D.O. 1795. Sponsoring Agency Report TCN 96-026. February 7, 1997.

Bonner, J. S., and R. L. Autenrieth. *Microbial Petroleum Degradation Enhancement by Oil Spill Bioremediation Products*. October 1995. Report submitted to Texas General Land Office (Comparative analysis of 13 NCP Listed Bioremediation Products, EA Type PAH reduction efficacy exceeded MC and NA Types).

BP BCST D. Tsao, LSU R. J. Portier, and L. M. Basirico. March 3, 2011. *Laboratory Screening of Commercial Bioremediation Agents for the Deepwater Horizon Spill Response*.

NRT SCIENCE AND TECHNOLOGY COMMITTEE Fact Sheet. May 2000. *Bioremediation in Oil Spill Response. An information update on the use of bioremediation*. US EPA.

U.S. Environmental Protection Agency, Office of Research and Development, National Risk Management Research Laboratory, Land Remediation and Pollution Control Division, 26 W. Martin Luther King Drive, Cincinnati, OH. Added bacteria seem to compete poorly with the indigenous population (Tagger et al., 1983; Lee and Levy, 1989; Venosa et al., 1992). Biostimulation alone had a greater effect on oil biodegradation than the microbial seeding (Jobson et al., 1974; Lee and Levy, 1987; Lee et al., 1997, Venosa et al., 1996).

US EPA. 2012. NCP Product Schedule. http://www.epa.gov/oilspill. http://www.epa.gov/oem/content/ncp/products/oseater.htm.

Zhu, X., A. D. Venosa, and M. T. Suidan. July 2004. EPA/600/R-04/075 *Literature Review on the Use of Commercial Bioremediation Agents for Cleanup of Oil-Contaminated Estuarine Environments*. http://www.epa.gov/oem/docs/oil/edu/litreviewbiormd.pdf.

Zhu, X., A. D. Venosa, M. T. Suidan, and K. Lee. September 2001. *Guidelines for the Bioremediation of Marine Shorelines and Freshwater Wetlands*. US EPA.

Zwick, T. C., E. A. Foote, A. J. Pollack, J. L. Boone, B. C. Alleman, R. E. Hoeppel, and L. Bowling. 1997. "Effects of Nutrient Addition during Bioventing of Fuel Contaminated Soils in an Arid Environment." *In Situ and On-Site Bioremediation* 1: 403–09. Columbus, OH: Battelle Press.

EA Type References

Bartman, Galen. *Oil Spill Eater Respirocity Evaluation CAI Lab. No. 3265*. July 1990. Additive [EA] has a meaningful and significant effect on decreasing the oil concentration and increasing the oxygen take up. [*Respirocity*: see http://en.wikipedia.org/wiki/Respirometry.]

Brown, Elvin E. University of Alaska Fairbanks. 1990. Bioremediation performed on PAHs shows extreme or great reduction in the target analytes using EA Type. Report of Exxon tested Bioremediation EA Type in 1989 at Florham Park, New Jersey, showing effective by a factor of better than 90% on the North Slope Alaskan crude oil from the *Valdez* spill.

Flores, M. en C. Gabriel Peneda, and Q.B.P. Norma Pescador Elizondo. 2002. Ecologia microbiana lab, University of Mexico—Instituto Politécnico Nacional, Escuela Nacional de Ciencias Biológicas. Efficacy test of EA Type on heavy (Maya crude) and medium-weight crude oil demonstrates significant reduction of PAHs (54% reduction in 30 days on the Maya crude, and medium crude reduced 80% in 30 days).

Louisiana State University, Department of Environmental Sciences. June 2011. *Characteristics, Behavior, & Response Effectiveness of Spilled Dielectric Insulating Oil in the Marine Environment*. For U.S. Department of the Interior Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), Herndon, VA. http://www.bsee.gov/uploadedFiles/BSEE/Research_and_Training/Technology_Assessment_and_Research/aa%283%29.pdf.

Merski, A. T. 1993. NETAC *Oil Spill Response Bioremediation Agents, Evaluation Methods Validation Testing, Discussion of Results*.

Resource Analysts, Inc. Subsidiary of Millipore. June 1990. References: 1) EPA SW 846, 3rd Edition. Determination of No Trace Elements and Chlorinated Hydrocarbons in EA Product.

Sowman, B. 16 July, 2012. Environmental Protection Authority New Zealand, Hazardous Substances Division. SOS # 1001797. Determination of the Status of Oil Spill Eater II—Non-hazardous.

State of Alaska. Legal Closure Letter. The soils have been remediated to the most stringent (ADEC) cleanup levels. 75–80, http://osei.us/tech-library-pdfs/2011/OSEI%20Manual_FINAL-2011.pdf.

State of New York. Groundwater remediation of heating oil by Alpha Geoscience with complete sampling and testing certified by NYSDEC. Summary and Results of In Situ Soil Remediation. Spill No. 95-16786. 80–86, http://osei.us/tech-library-pdfs/2011/OSEI%20Manual_FINAL-2011.pdf.

US Marine Corps at Twentynine Palms utilizing EA remediated tank washout and several types of fuels (including tretraethyl lead) to State of California acceptable levels, DOD Environmental Award. "Testing and Evaluation of Enzymatic Catalysis for the Remediation of Petroleum Contaminated Soils." October 1993. 66–68, http://osei.us/tech-library-pdfs/2011/OSEI%20Manual_FINAL-2011.pdf.

Ward, R. H. SRI San Antonio Texas. 1999. EA Type does not sink oil into water column or sediments. Swirl Flask Dispersant Effectiveness Test. SwRI Project 08-2326-088. Work Order 8783.